Evaluation of a Novel Biologically Inspired Trajectory Generator in Human-Robot Interaction

Abstract:
In many future joint-action scenarios, humans and robots will have to interact physically in order to cooperate successfully. Ideally, human-robot interaction should not require training on the human side, but should be intuitive and simple. Previously, we reported on a simple case of physical human-robot interaction, a hand-over task. Even such a basic task as manually handing over an object from one agent to another requires that both partners agree upon certain basic prerequisites and boundary conditions. While some of them are negotiated explicitly, e.g. by verbal communication, others are determined indirectly and adaptively in the course of the cooperation. In the previous study we compared a human-human hand-over interaction with the same task performed by a human and a robot. However, the trajectories used for the robot, a conventional trapezoidal velocity profile in joint coordinates and a minimum-jerk profile of the end-effector, have little resemblance to the natural movements of humans. In this study we introduce a novel trajectory generator that is a variation of the traditional minimum-jerk profile, the 'decoupled minimum-jerk' profile. Its trajectory is much closer to those observed in human-human experiments. We evaluated its performance concerning human comfort and acceptance in a simple hand-over experiment by using a post-test questionnaire. The evaluation of the questionnaire revealed no difference with respect to comfort, human-likeness, or subjective safety of
the new planner compared to the minimum-jerk profile. Thus, the 'decoupled minimum-jerk' planner, which offers important advantages with respect to target approach, proved to be a promising alternative to the previously used minimum-jerk profile.

Stichworte: baja, jast, joint-action, robotics, cotesys

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